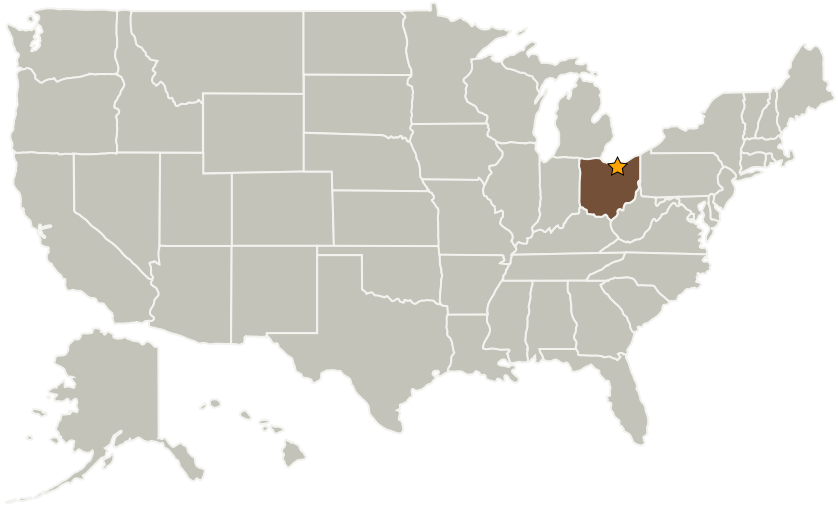
Physics-Based Probabilistic Design Tool with System-Level Reliability Constraint, Phase I

Completed Technology Project (2005 - 2005)

Project Introduction

The work proposed herein would establish a concurrent design environment that enables aerospace hardware designers to rapidly determine optimum risk-constrained designs subject to multiple uncertainties in applied loads, material properties, and manufacturing processes. This means that the design process no longer would consist of a sequence of separate code invocations to: (1) obtain the geometry model, (2) determine the various loads, (3) determine performance, (4) perform a structural analysis, (5) perform design optimization, and (6) perform a probabilistic risk assessment. Instead, all of these functions would be automatically incorporated into a single framework using existing physics-based deterministic modeling codes and a set of computer-generated data transfer interfaces. Thus, a design engineer would be able to rapidly explore the design space to identify the minimum weight design that meets a given reliability constraint ? thereby avoiding both an overly conservative design and a too-risky design. For example, the software tools that implement this innovation could be used to determine the wall thickness of a launch vehicle's external cryogenic propellant tanks exposed to high but uncertain thermal and aerodynamic loads and with a reliability probability of 0.99999.

Primary U.S. Work Locations and Key Partners



Physics-Based Probabilistic Design Tool with System-Level Reliability Constraint, Phase I

Table of Contents

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Glenn Research Center (GRC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Physics-Based Probabilistic Design Tool with System-Level Reliability Constraint, Phase I

Completed Technology Project (2005 - 2005)

Organizations Performing Work	Role	Type	Location
★Glenn Research Center(GRC)	Lead Organization	NASA Center	Cleveland, Ohio
N&R Engineering	Supporting Organization	Industry Small Disadvantaged Business (SDB)	Parma Heights, Ohio

Primary U.S. Work Locations
Ohio

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

William Strack

Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - TX12.2 Structures
    - TX12.2.3 Reliability and Sustainment